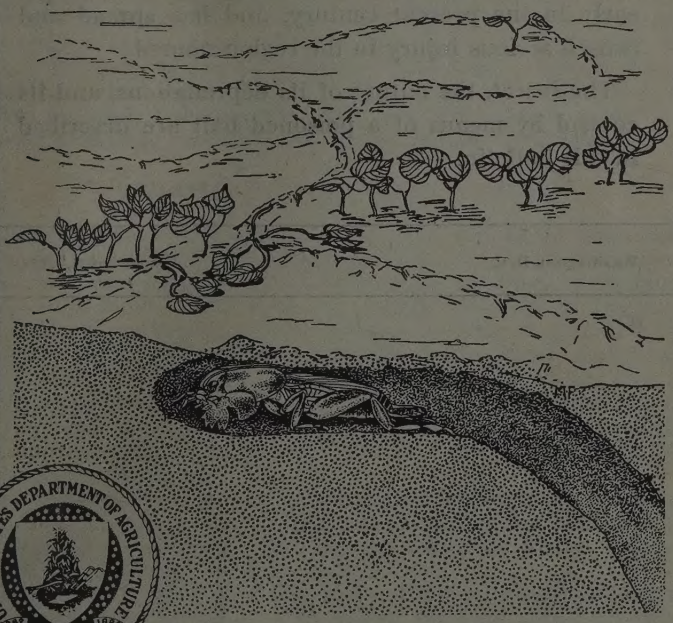
F 2 A

U. S. DEPARTMENT OF AGRICULTURE
FARMERS' BULLETIN No. 1561

IMP. BUR.
23 JUN. 1928
ENTOM.

The PORTO RICAN MOLE CRICKET



UNITED STATES DEPARTMENT OF AGRICULTURE
1862 AGRICULTURE OFFICE AND COMMERCE 1889
FOUNDATION OF MANUFACTURES

IN THE COASTAL AREA of Georgia, South Carolina, and North Carolina truck crops and some other cultivated growths are subject to injury by the Porto Rican mole cricket. This insect, a native of the West Indies and South America, seems to have been brought to the United States from Porto Rico early in the present century, and has spread and caused serious injury in the region named.

The insect, the nature of its depredations, and its control by means of a poisoned bait are described in this bulletin.

Washington, D. C. Issued April, 1928

THE PORTO RICAN MOLE CRICKET

By W. A. THOMAS, *Assistant Entomologist, Division of Truck-Crop Insects, Bureau of Entomology*

CONTENTS

	Page		Page
Many kinds of crops damaged	1	Habits of the mole cricket	4
Description of the mole cricket	1	Keeping down mole crickets with poisoned bait	6
How the mole cricket injures the crop	2	The bait and how to mix it	6
Seasonal activity of the mole cricket	2	How and where to use the bait	7
Where the mole cricket came from and where it now occurs	3	Quantity of bait per acre, and cost	7
Life of the mole cricket	3		

MANY KINDS OF CROPS DAMAGED

TRUCK CROPS, especially in the seedling stage, in the coastal area from the southern border of Georgia to Wilmington, N. C., are subject to injury by the Porto Rican mole cricket,[1] known also in some sections as the changa or "ground puppy." Injury by the mole cricket, however, is not confined to truck crops; tobacco, peanuts, grasses, and chufas may also be damaged. Since the insect lives and thrives in moist, light soil, the lands devoted to truck crops in the infested area offer very favorable conditions for this pest.

DESCRIPTION OF THE MOLE CRICKET

Although the Porto Rican mole cricket belongs to the same family of insects as do the common hearth cricket and the field crickets, it does not to any great extent resemble other members of its family. The mature mole cricket ranges in length from 1¼ to 1½ inches, and is about one-fourth inch in width. In color it is light brown, the lower surface being much lighter than the upper, and slightly tinged with green. It is covered with fine hairs which give it a velvety appearance. The hind, or body, parts of the insect are soft, but the head and midsection bear a hard covering which protects it in its movement through the soil. The head carries a pair of thread-like antennae, or feelers.

The insect's most striking features are the rather large, beady eyes, and short, stout front legs, which bear shovellike feet well fitted for digging. The middle and hind legs are somewhat longer, especially the latter, and comparatively slender.

The mature crickets have two pairs of wings, which when at rest are folded along the back. The tips of the hind wings are curved

[1] *Scapteriscus vicinus* Latr.; order Orthoptera, family Gryllidae, subfamily Gryllotalpinae.

downward, and reach just beyond the hind end of the body; the forewings are much shorter and rounded at the tips.

The immature form is similar in appearance to the adult, except that it is smaller and wingless.

HOW THE MOLE CRICKET INJURES THE CROP

The greatest damage caused by the mole cricket to crops results from its burrowing in the upper inch or two of the soil. The burrows resemble those of a very small ground mole, the ground being pushed upward as the insect moves through it in much the same manner as it is pushed up by the mole. It is usually these ridges in the soil that give the first indication of the presence of the pest. The constant burrowing of the insect keeps the soil in the seed bed and about the plants in the field in such a disturbed condition that the sprouting seed and young plants can not develop properly. This burrowing is particularly destructive to seed beds, in which, because of it, many seeds fail to germinate and the seedlings die through the breaking of the delicate root system. Seedlings in the field are uprooted, and many dry out and die, as the burrows permit rapid evaporation of the surface moisture.

Injury resulting from the insect's feeding upon the crop is relatively small, although the mole cricket cuts off young plants and also feeds upon the seed, and these depredations cause considerable loss.

Aside from the injuries which result from its burrowing habit, the mole cricket cuts pits from one-eighth to one-fourth inch in diameter and varying in depth in the tubers of potatoes. In some cases this type of injury is severe enough to render the product unsalable. Sweet potatoes are subject to similar injury, although attacks on this crop are less frequent. In the early part of the season the seed of the peanut crop is fed upon, and in the fall the insect cuts openings in the shell of the mature nut and devours its contents. Chufa is injured in the fall by the insect, which feeds on the mature, fleshy root of the plant. Injury to this crop in the spring by the mole cricket has not as yet been observed. Seedling tobacco plants are damaged, both in the seed bed and in the field; in the former the mole cricket uproots and cuts off the seedlings. The mole cricket also injures the tobacco by girdling the stems of the plants shortly after they are transplanted to the field.

Among truck crops turnip, lettuce, spinach, kale, eggplant, tomato, beet, collard, cauliflower, and seedling onion suffer the greatest damage.

SEASONAL ACTIVITY OF THE MOLE CRICKET

The injury to the crop by the mole cricket usually first becomes noticeable in the latter part of March and continues until about the middle of June, the heaviest damage occurring during the latter part of April and early in May. At this time the overwintering forms are approaching maturity and seasonal conditions are favorable to their greatest activity. The first individuals of the new generation usually begin to appear in June and hatching continues until early in August. Seldom does any appreciable damage occur in the course

of this period. The young forms are as active as the nearly mature ones, but because of their small size their work in the soil is not so noticeable. Surface conditions are also not so favorable to the young forms. The period of activity in late summer and fall, the most serious of the entire year, extends from August until late in October, the greatest activity occurring during the latter part of September. The late season is usually dry, and the surface burrowing which generally follows rains is particularly destructive to germinating seed and newly set plants.

WHERE THE MOLE CRICKET CAME FROM AND WHERE IT NOW OCCURS

The mole cricket is a native of the West Indies and South America, and there are indications that it was introduced into this country from Porto Rico in the ballast of ships from that island or possibly from others of the same group. As far as can be determined, the first reports of injury caused by it in the United States were received from the coastal section of Georgia a few years prior to 1909. Since that time the insect has spread, and it is now known to occur in the coastal section from below the southern boundary of Georgia to Wilmington, N. C., extending inland from the coast for a distance of about 100 miles.

At the present time the most serious injury occurs in the vicinity of Brunswick, Darien, Savannah, St. Marys, Folkston, and Beach, in Georgia; Beaufort, Charleston, Summerville, Kinstree, McClellanville, Georgetown, Myrtle Beach, Little River, and Wampee, in South Carolina; and Shallotte, Supply, Southport, and Wilmington, in North Carolina. The insect has also been reported from Jacksonville and Ortega, Fla. One report of its occurrence in Louisiana has been recorded.

The rate of spread is about 25 miles per year along the coast and slightly less toward the interior.

LIFE OF THE MOLE CRICKET

The insects of the group to which the mole cricket belongs do not have the four completely distinct stages of egg, larva, pupa, and adult, so characteristic of many insects. Instead, the mole cricket and all insects of its group are, when hatched from the egg, of the same general form as the adult parent, but wingless. As the insect grows it sheds its skin several times, and wings develop more or less gradually, until it becomes mature. After the egg, the mole cricket passes through eight such stages; the adult, in the last of these, lays the eggs from which the new series of stages will proceed. The first five immature, or nymphal, stages are wingless; in the sixth wing pads appear, and the adult has fully developed wings.

The mole cricket passes the winter in the ground, principally in an immature or nymphal stage. The immature, overwintering forms become active in March, and usually reach the adult stage some time in May or June. Soon after reaching maturity the females prepare an earthen cell at the end of a short burrow off from one of its main burrows, located from 1 inch to 4 inches below the surface. Small, greenish, oval-shaped eggs about one-eighth inch long by one-six-

teenth inch in diameter are laid in these cells, generally from 40 to 50 eggs being placed in each. (Fig. 1.) The eggs hatch in about three weeks, and hatching continues until early in August.

For the first few days of their life the young are very sluggish and remain in the egg chamber, or earthen cell. After leaving the egg chamber they become very active and burrow in every direction in search of food. During their early stages the rate of growth is very rapid, but it slows up as the insects approach maturity. When the mole cricket has become about two-thirds grown it acquires wing pads, and from six to eight months after hatching from the egg it becomes mature and has fully developed wings.

The mature forms of the insect are found in greatest numbers in May, June, and July, although a few may be seen from late in October on through the winter. In Figures 2 and 3 the mole cricket is shown in several of its eight developmental stages.

FIG. 1.—Lump of soil with cavity containing eggs of the mole cricket. The eggs are laid in the cavity which the female cricket makes at the end of a burrow. Enlarged about 1¼ diameters

HABITS OF THE MOLE CRICKET

Mole crickets live in burrows in the ground in much the same way as does the common ground mole. They thrive best in light, moist soils, which are easy for them to burrow through. The more compact, heavy clay soils are difficult for the insects to tunnel in, with the result that they are seldom found destructive in such land.

The depth at which they are to be found depends upon the soil moisture and temperature. When the soil is moist and warm, mole crickets burrow just beneath the surface. With a drop in temperature, or the drying of the surface soil, they move downward to a more suitable level. As the season advances and the surface soil becomes dry and hot they may go down to considerable depths in order to find favorable surroundings. During dry periods they may be found, however, working in the loose, moist soil in the bottom of field ditches or along roadways. The winter season is spent below the frost line.

Mole crickets are very active little creatures, burrowing through the soil both day and night in search of food. They avoid bright light, and if exposed to it will seek cover either in the soil or under some near-by object, burrowing in with great rapidity. At night their burrows are often deserted, the insects going to the surface in search of food. They have frequently been observed, especially

where the soil was very compact or wet, traveling freely over the surface. Very often, instead of leaving its burrow, a mole cricket will push its head and a part of its body through the soil; and after remaining in this position for a few seconds, as if viewing surface surroundings and not finding them to its liking, it will disappear and continue its burrowing. There is apparently no particular time at night when the insect is more active than at another, but it is usually found on the surface the first hour or so after dark.

Evidences of the work of mole crickets are much more apparent after rainfalls, followed by warm, cloudy weather, than at other times.

The normal food of the Porto Rican mole cricket consists largely of decaying vegetable matter and a small quantity of animal matter. This pest frequents compost piles, where it often congregates in very large numbers. Fresh horse droppings strongly attract mole crickets. Remnants of crops, such as cabbage, lettuce, turnip, cantaloupe, and watermelon, partly covered by the soil after plowing, are favorite sources of food.

The mole cricket spreads chiefly by flight. Females have often been observed several miles in advance of normally infested areas. During migration the insect follows the ditches along highways and watercourses, where loose, moist earth is to be found. In newly infested areas the insect is first noticed about watering places on the farm, where the overflow from wells and watering troughs keeps the soil sufficiently moist to provide attractive locations.

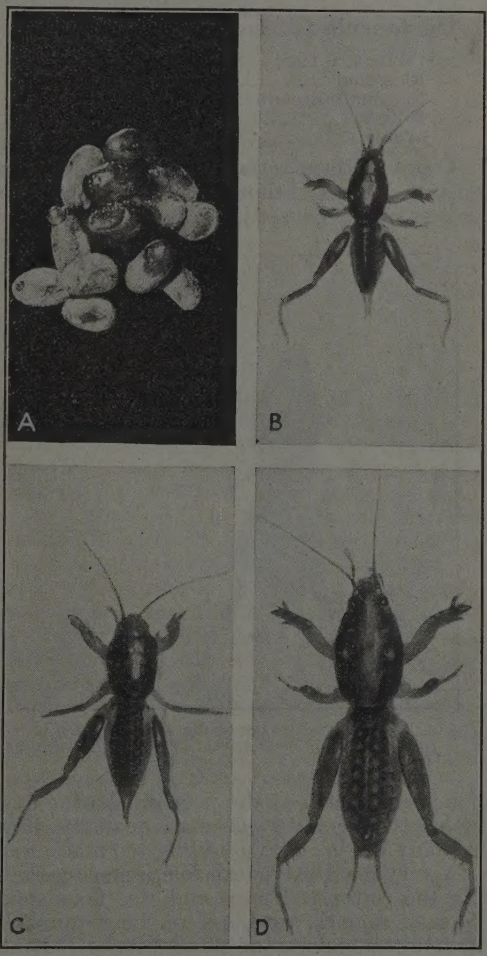


FIG. 2.—Stages of growth of the mole cricket: A, eggs; B, mole cricket about 4, and C, about 10, days old; D, immature form about 4 weeks old. Enlarged about 3 diameters

KEEPING DOWN MOLE CRICKETS WITH POISONED BAIT

Since mole crickets feed above ground at night, they can be controlled by using a poisoned bait.

THE BAIT AND HOW TO MIX IT

The formula for the bait is as follows:

Cottonseed meal	pounds	100
Rice flour	do	100
Calcium arsenate[2]	do	10
Molasses	gallons	1
Water	do	9

Thoroughly mix the cottonseed meal, rice flour, and calcium arsenate. Even and thorough distribution is very important, as for the success of the bait it is necessary that each particle of the meal and

FIG. 3.—Last two stages of the mole cricket: A, last nymphal stage, with wing pads; B, adult mole cricket, with fully developed wings. Enlarged about 1¼ diameters

flour carry some of the poison. To the dry mixture add the mixed molasses and water, a small quantity at a time, so as to form a crumbly mash. Avoid adding too much water.

A very good procedure for preparing the bait consists in first mixing the cottonseed meal and rice flour together on a smooth, clean floor, or smooth, hard area of the ground. Then spread the material to an average depth of about 3 inches. Next, scatter one-third of the calcium arsenate as evenly as possible over the mixture of cottonseed meal and rice flour. Then begin at one edge, with a potato fork or hoe, and gradually work the material back toward the operator, making short strokes, until the whole pile has been stirred. Next draw the material from all edges toward the center to form a pile.

[2] Paris green or white arsenic can be substituted for calcium arsenate, but since calcium arsenate is readily available in the affected region it is recommended here as a poison for the bait.

Spread the material again to a depth of about 3 inches and apply another third of the calcium arsenate to the surface, and repeat this process until the required quantity of calcium arsenate has been added. Add only a small quantity of the molasses solution at a time, and work this in thoroughly, adding more as needed, just as is done in mixing mortar or concrete for building purposes.

When only a small quantity of the poisoned bait is needed, for treating a small seed bed or similar area, the following formula may be used:

Cottonseed meal	pounds	5
Rice flour	do	5
Calcium arsenate	do	½
Molasses solution, 1 to 10	quarts	2

This quantity may be mixed with the hand in a large pail or a half-bushel tub. Do not use the hands for mixing the poisoned bait if there are abrasions on them, as poisoning may result. In such a case a small paddle may be used in the mixing. To avoid fermentation, which renders the bait ineffective, the mixture should be used within 48 hours after it is prepared.

HOW AND WHERE TO USE THE BAIT

A convenient method of applying the poison bait is to scatter it by hand from a bucket of about 3-gallon capacity. In treating unplanted areas, the bait should be sown broadcast, the first treatment being made about 10 days before planting and another immediately after planting. In cases where the crop has been planted in rows the bait should be applied by scattering it lightly between alternate rows, since the surface moisture usually found between the rows is more favorable to the mole crickets than is newly planted ground.

When necessary to treat the growing crop, scatter the bait lightly between the rows of plants. Repeat the application every week or 10 days until the presence of the mole cricket is not noticeable.

To treat a seed bed, scatter the bait lightly over the entire bed, and repeat the treatment immediately after seeding.

For treatment of grasslands or lawns, scatter the bait lightly over the area. Repeat every week or 10 days until all signs of mole crickets disappear. In case of a small area, reinfestation often takes place from adjacent untreated ground in the course of from four to six weeks; to prevent this occurrence the lawn should be treated with the poisoned bait once every month or six weeks during the warmer months of the year.

Ordinarily two applications are sufficient to control the mole crickets on any one vegetable crop. It is sometimes necessary, however, to make three or more applications in order to get complete control. If a heavy rain immediately follows an application, another application should be made as soon as possible thereafter.

QUANTITY OF BAIT PER ACRE, AND COST

Under ordinary conditions, 150 pounds of the dry material (weight before moistening) is sufficient to cover 1 acre, either broadcast or in rows 5 feet apart. If the crop to be treated is in rows, the application should be made directly to them, the same quantity of material

being used per acre. At this rate of application about one-fourth of a pound is sufficient for 100 square feet, or 100 linear feet of row.

The cost of controlling the mole cricket will vary, and will depend largely upon the cost of labor. Ordinarily two applications will be sufficient. Including the expense of material and of the labor of mixing and applying, one treatment will cost from $2 to $4 per acre.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

April 6, 1928

Secretary of Agriculture	W. M. JARDINE.
Assistant Secretary	R. W. DUNLAP.
Director of Scientific Work	A. F. WOODS.
Director of Regulatory Work	WALTER G. CAMPBELL.
Director of Extension	C. W. WARBURTON.
Director of Personnel and Business Administration	W. W. STOCKBERGER.
Director of Information	NELSON ANTRIM CRAWFORD.
Solicitor	R. W. WILLIAMS.
Weather Bureau	CHARLES F. MARVIN, *Chief.*
Bureau of Animal Industry	JOHN R. MOHLER, *Chief.*
Bureau of Dairy Industry	L. A. ROGERS, *Acting Chief.*
Bureau of Plant Industry	WILLIAM A. TAYLOR, *Chief.*
Forest Service	W. B. GREELEY, *Chief.*
Bureau of Chemistry and Soils	H. G. KNIGHT, *Chief.*
Bureau of Entomology	C. L. MARLATT, *Chief.*
Bureau of Biological Survey	PAUL G. REDINGTON, *Chief.*
Bureau of Public Roads	THOMAS H. MACDONALD, *Chief.*
Bureau of Agricultural Economics	LLOYD S. TENNY, *Chief.*
Bureau of Home Economics	LOUISE STANLEY, *Chief.*
Federal Horticultural Board	C. L. MARLATT, *Chairman.*
Grain Futures Administration	J. W. T. DUVEL, *Chief.*
Food, Drug, and Insecticide Administration	WALTER G. CAMPBELL, *Director of Regulatory Work, in Charge.*
Office of Experiment Stations	E. W. ALLEN, *Chief.*
Office of Cooperative Extension Work	C. B. SMITH, *Chief.*
Library	CLARIBEL R. BARNETT, *Librarian.*

This bulletin is a contribution from

Bureau of Entomology	C. L. MARLATT, *Chief.*
Division of Truck-Crop Insects	J. E. GRAF, *Senior Entomologist, in Charge.*

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
U. S. GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY